





In a world of kaleidoscopic scientific developments and unsettling social innovations, the Howe Laboratory continues to pursue its own course hopefully toward betterment of mankind through research on the eye. The future will have to judge how successful this course may have been; in the meantime this Annual Report serves to record the activities of 1961 from the present year-end perspective.

In reviewing these activities one feels a deep gratitude and respect for those investigators and benefactors who have contributed to the common effort. It is a great privilege to be part of a team that has the essential qualities for research and a benevolence directed toward the humanitarian goal of prevention of blindness through knowledge of the eye.

### RESEARCH ACTIVITIES

*Glaucoma.* This disease is a frequent cause of loss of vision, affecting patients of all ages. In the Howe Laboratory glaucoma has been the subject of much research for more than two decades, with significant advances in understanding and treatment already accomplished. In pursuit of more knowledge and better treatment, a close combination of clinical and laboratory research is continuously carried on, based principally on special studies of patients and on special examinations of eyes donated through the Eye Bank for this purpose. Doctor Grant of the Howe Laboratory supervises the Glaucoma Consultation Service of the Infirmary and, with the resident staff and an occasional research fellow, has opportunity to study in detail the clinical characteristics of glaucoma and responses of different types of the disease to various forms of treatment.

Of particular clinical interest in the last several years has been a special study of the glaucoma of infants and children. A guide to better treatment is being sought through methodical analysis of results of various means of treatment. Also, special methods have been devised for use on infants for measurement of intraocular pressure and for microscopy during surgery.

Doctor Pinkerton, a research fellow on the Glaucoma Consultation Service for the first half of the year, and Doctor Grant have devised a punch-card system to render more manageable and ac-

cessible the vast amount of clinical information on glaucoma which is being accumulated. It is hoped that by this means answers to many questions may be more readily found.

Doctors Pinkerton and Grant have carried out a clinical evaluation of guanethidine (Ismelin), a new drug used in treatment of glaucoma, and found some promise that it may be useful particularly in young adults who experience unpleasant nearsightedness with miotic drops.

In the laboratory, Doctor Grant uses special equipment for detailed study of the hydrodynamics of the eye. Measurements with this equipment on enucleated normal human eyes provide necessary information for recognizing, by comparison, what is wrong with glaucomatous eyes. From year to year information has been accumulated on the anatomic sites and nature of obstruction to outflow of aqueous humor in glaucoma, on the role of the ciliary body, iris, lens and vitreous humor in determining the resistance to outflow, on the influence of enzymes applied experimentally, and on various surgical procedures such as may be employed therapeutically.

A detail upon which some light has been shed this year pertains to a clinical enigma of the role of vitreous humor in the anterior chamber in certain types of glaucoma. It has now been established by experiment that vitreous in the angle of the anterior chamber can cause glaucomatous obstruction of the outflow channels.

Because of his many contributions to ocular hydrodynamics and most especially for his development of tomography, Dr. Grant was awarded this past year the Knapp Medal by the Section of Ophthalmology of the American Medical Association. This award is made at approximately 5 year intervals to scientists who have made significant contributions to ophthalmology.

*Vascular Patterns in the Retina.* The technique, developed by Dr. Kuwabara, for preparation and study of the retinal vessels has proved most informative. It has been possible for the first time to observe in whole flat mounts the cells that constitute the vessel walls and to characterize their aberrations in disease. An exhibit based on this new method of investigation and some of

the preliminary results was awarded the Hektoen Silver Medal at the annual meeting of the American Medical Association.

Subjected to special study this past year were vessel changes in the retinas of patients afflicted with diabetes. There is no doubt that diabetic retinopathy is one of the most serious causes of blindness and it seems most plausible to think that the primary abnormality is in the small vessels. The present study has indicated a selective loss of special cells in the vessel walls which we have called mural cells. Microaneurisms, which are most characteristic of diabetes are found to occur at the former sites of these mural cells. It has now been possible to document a series of histologic abnormalities in the vessel walls representing progressive changes from simple and asymptomatic loss of mural cells to advanced microaneurism formation. This latter is often accompanied by severe hemorrhagic and proliferative retinopathy leading to blindness.

The study on the retinal vessels, which has been a continuing interest of Drs. Kuwabara and Cogan, was assisted this past year by Dr. Daniel Toussaint, who worked particularly on the effects of diabetes, and by Drs. Robert Reinecke and Donald Weiss, who investigated experimental vascular occlusion. In addition, the technique of vessel preparation developed in the Howe Laboratory is coming to be used in many other laboratories throughout the world for a new look at vascular retinopathies. Plans for the future call for extension of these studies with use of the electron microscope and an attempt to gain insight into fluid transfer across the capillary bed of the retina. For the electron microscopy, Dr. Kuwabara will be assisted by Dr. Michio Oikawa, who has had unique experience with electron microscopy in Japan, and by Dr. Arnold Kroll who is a pre-residency trainee at the Laboratory. The physiologic aspects of fluid transport in the retina will be explored by Dr. Ephraim Friedman who is spending a post-residency year in ophthalmic research at the Howe Laboratory.

*Biochemical studies on the Lens.* Studies of the energy metabolism clearly indicate that the calf lens relies primarily on the Embden-Meyerhof pathway for its energy. Dr. Kinoshita and Mr. Merola have found that although the citric acid cycle functions, its contribution to the overall energy production appears small. In fact, as long as the lens is adequately supplied with

glucose it appears to meet all its energy requirements through the anaerobic mechanism. This is consistent with the observations that in lens the cation transport mechanism and amino acid incorporation into lens proteins — energy expending processes — can be entirely supported by anaerobic glycolysis provided glucose is available. Study of the citric acid cycle in lens utilizing radioactive pyruvate as the substrate has revealed that considerable quantities of pyruvate are converted to glutamic acid, one of the component amino acids of glutathione. Furthermore, a significant amount of radioactivity appears in glutathione itself. These findings suggest that by providing sufficient quantities of glutamic acid through the citric acid cycle the lens is geared to production of glutathione. In freshly removed calf lens glutamic acid is found to be present in high concentration second only to glutathione. These observations further emphasize the importance of glutathione in lens. The precise role it plays, however, remains an intriguing and challenging mystery.

Studies of the reactions which initiate glycolysis in the lens have been continued. Besides its obligatory phosphorylation, glucose is involved in an unusual series of reactions. The lens is capable of reducing glucose to sorbitol, and this alcohol sugar in turn is oxidized to fructose. Since large quantities of sorbitol and fructose accumulate in lens of animals made diabetic by means of alloxan, the sorbitol pathway has been actively investigated. Dr. Kinoshita and his associates have obtained evidence indicating that the conversion of glucose to fructose may provide an alternate mechanism by which glycolysis proceeds. The possibility exists that fructose provides an entry into the glycolytic mechanism that by-passes the hexokinase reaction. The nature of the enzyme which phosphorylates fructose and the conversion of fructose to lactic acid are currently being investigated.

It is becoming increasingly obvious that to understand the nature of cataract development, all phases of the biological properties of lens must be explored. It is generally accepted that any interference in the production of biological energy derived through the metabolism of glucose results in the development of opacities. The opacification of lens appears to be due to changes in lens proteins. Drs. Abraham Spector and Selma Hayman are therefore studying the chemistry and metabolism of lens proteins. They have developed a method for separating soluble lens proteins into

three classes by chromatographic and electrophoretic techniques. Alpha crystallin characterized by a low sulfhydryl content is the largest of the lens proteins with a molecular weight near a million. Beta crystallin represents a group of proteins rich in sulfhydryl content and of intermediate molecular size. Gamma crystallin, the smallest of the lens proteins, also has a high sulfhydryl content.

As reported last year a study of proteolysis in lens has led Dr. Spector to study amino acid esterase activity. The enzyme has been isolated from lens and the properties studied. The substrate and metal requirements clearly eliminate any possibility of relating the esterase activity to any known protease. However, peptidase activity may be associated with the esterase. Since no amino acid esters or dipeptides have been found in lens, the question arises as to the physiological role of these active enzymes. The possibility that these hydrolytic enzymes may function in the synthesis of proteins is being explored.

*Biochemical and Histochemical Studies on the Retina.* The phenomenon of vision begins in the retina. In its outermost portion a photochemical reaction involving derivatives of vitamin A converts a light impulse into an electric impulse. Thence the impulses are transmitted by two neuronal relays to the nerve fibers that transmit them to the brain. All this requires energy. The metabolism of the retina may thus be said to revolve around the photoreceptive process on the one hand and the energetic requirements of the retinal cells on the other hand.

A new method developed by Dr. Futterman (in collaboration with Dr. Saslow) for quantitative determination of vitamin A aldehyde has shown that three enzymes can oxidize the aldehyde to vitamin A acid: aldehyde dehydrogenase, aldehyde oxidase, and milk xanthine oxidase. Currently these observations are being applied to the retina where vitamin A aldehyde is an essential part of the photosensitive pigment and where lack of vitamin A results in degeneration of the photoreceptors.

The energy requirements of the retina appear to be provided by glucose directly from the blood or indirectly from stores of glycogen in the retina. It has previously been established by Drs. Kuwabara and Cogan that Müller's fibers in the retina can synthesize and store glycogen. Now, Dr. Thomas Hutchinson, a pre-

residency trainee in the Laboratory, is exploring the enzymatic pathways by which this glycogen is built up and broken down in the retina. At the same time Dr. Arnold Kroll is exploring with the electron microscope the distribution of mitochondria that are essential to the normal catabolic requirements of the retina. These observations together with the dehydrogenase studies noted in previous Reports should make for a well rounded knowledge of metabolic processes in the retina.

*Biochemical Studies of Lipid Synthesis.* Aberrant lipogenesis has been high lighted in previous reports and constitutes a continuing activity in the Howe Laboratory. The phenomenon, best studied in the cornea, but applicable to many tissues, has yielded fundamental information on fatty necrosis, atheromatosis, and lipid keratopathy.

During the past year Dr. J. S. Andrews has studied lipid synthesis in corneal homogenates (suspension of broken corneal cells) incubated with serum and fatty acids. It is expected that this will serve to identify the active intracellular components and facilitate identification of the elusive serum factor.

A chemical analysis of the fat in arcus senilis has shown it to be composed principally of sterols and especially of sterol esters. Scleras from eyes with arcus senilis were also shown to have an abnormal accumulation of these sterols.

*Experimental monitoring of intraocular pressure.* By means of permanently implanted polyethylene tubes in the anterior chambers of rabbit eyes, Dr. Kupfer has been able to record the intraocular pressure continuously for periods of 6 hours and repetitively over a period of weeks. This is the first time the intraocular pressure has been continuously recorded directly in the ambient animal. Samples of aqueous humor were also removed periodically for chemical analysis. On the basis of concentration of ascorbic acid and total protein in the aqueous humor, it appears that the permeability of the blood-aqueous barrier is but slightly changed from normal values by this procedure. Dr. Kupfer is now attempting to determine directly the facility of outflow by perfusing the anterior chamber via the implanted tubes and measuring changes in intraocular pressure.

*Herpes simplex, toxoplasmosis and nematodes.* A special division of the Howe Laboratory, organized and directed by Dr. Herbert Kaufman, has centered its attention on herpes simplex infection, toxoplasmosis and nematodes. All three are of great importance to ophthalmology, the first because of the common corneal diseases, dendritic keratitis and metaherpetic keratitis, and the latter because of the relatively common toxoplasmic and nematode chorioretinitides.

What appears at present to be a major breakthrough is Dr. Kaufman's discovery of an effective means for treating keratitis caused by herpes simplex virus, which has not previously been found susceptible to antibiotics or antiviral agents applied to the eye. By using 5-iodo-2' deoxyuridine which is an antimetabolite (or thymidine antagonist) Dr. Kaufman found a rapid resolution of the keratitis in experimental animals. Preliminary observations on human infections are also most promising. This could be a major discovery not only for ophthalmology but for medicine as a whole since herpes simplex and allied viruses are the cause of many diseases in the body.

Other studies of herpes simplex have shown: the diagnostic usefulness of fluorescent antibody staining, described in last year's report; the undesirable effects of cortisone on herpetic keratitis; the failure of curettage to prevent recurrences; and the inefficacy of Interferon as a therapeutic agent for herpetic keratitis.

The studies on toxoplasmosis have shown a good correlation between skin test and dye test and the important role of hypersensitivity in recurrences of the disease. The nematode studies are still in the preliminary stages but there is some promise of a precipitin test of the serum antibodies that may aid in the diagnosis of the disease.

Assisting Dr. Kaufman in these studies have been Mrs. Emily D. Mahoney, a full time participant in the program, Drs. George Howard and Anthony Nesburn, pre-residency trainees and William Gilbert, medical student.

*Toxicology of the Eye.* Not since 1913 when two German workers published a book on the subject, has a comparable study been made on toxicology of the eye. Yet the importance of having

some up-to-date source of reference is obvious. Dr. Grant has been accumulating relevant data and making personal observations on the subject for 20 years. This collective experience and review of the literature has been formulated in a book, entitled "Toxicology of the Eye" which is to be published in 1962.

The book is intended to be of use primarily to ophthalmologists as a convenient source of information on drugs and chemicals which are injurious to the eyes or otherwise disturb vision, either by local contact or by systemic action. The book covers approximately 1600 substances, summarizing what has been published in the last 100 years, and providing previously unpublished observations on more than 200 substances. This information is presented in simple form as in an encyclopedia, alphabetically by substances. Extensive cross-referencing is provided for locating information also according to signs and symptoms.

*Instrumentation and optics.* The semi-diagrammatic representation of an object in three dimensions can be accomplished by the artist through painstaking and time-consuming work. Apparently, no mechanical or electronic equipment has ever been made which would successfully produce such stereograms. Dr. Donaldson's particular interest in this field stems from his efforts in the teaching of the neuroanatomy of visual pathways in the post-graduate course. Some years ago, several stereoscopic drawings were made by Mr. Lee Allen at State University of Iowa and have proven to be of considerable help in the teaching of neuro-ophthalmic anatomy. However, it is obvious that this approach could be expanded to make it possible to visualize more completely the complexities of the ocular motor and visual pathways. Dr. Donaldson has now built a piece of equipment which will allow the scanning of actual anatomical preparations. This procedure results in a pair of stereoscopic drawings which represent the particular pathways and anatomical structures of ophthalmic significance.

Since Dr. Donaldson made his first stereoscopic anterior segment camera some 14 years ago, about fifty of them have been produced and are being used in institutions in the United States and abroad. Although an optical firm did produce the camera for a time, it did not prove to be a profitable venture for them and at the present time there are a number of institutions that would like to have a camera. The production of these cameras remains a problem.

However, over the years Dr. Donaldson has made many changes in the camera, the most recent of which was to incorporate the power supply into the base of the camera. This not only simplifies the operation of the camera but makes it much easier to transport. Another change in the design makes it possible to convert easily and quickly from a setting which will produce a natural appearing depth effect in the stereo viewer to a setting which will give a proper depth effect when the picture is used in stereoprojection.

Although the majority of fundus photographs are satisfactory when taken with the presently available equipment, pictures are of poor quality when the patient has even slight opacities of lens or anterior vitreous. This is due to the diffusion and back scatter of the light as it traverses the pupil and media of the eye. Dr. Donaldson has now designed and made a glass light pipe which condenses the light output of a 200 watt-second electronic flash into an area  $\frac{1}{4}$  inch in diameter. The end of the light pipe can be placed directly in contact with conjunctiva over the pars plana region. By so doing the fundus is illuminated without putting the light through the pupil and thus avoiding the back scatter problem which is not infrequently a limiting factor in fundus photography. The same equipment may be useful in certain cases where transillumination of retinal lesions is desired.

*Electron Microscopy.* The electron microscope that was installed just in time to be noted in last year's Report has given a full year of service. Most attention has been directed to the fine structure of the retina. In addition to supplementing some of the vessel studies it is being utilized for the localization of dehydrogenases in the retina and for the study of morphologic connections of the neuronal and glial cells. Recent observations, mostly from this Laboratory, that the Müllerian glia serve a vital metabolic role in addition to their supporting function has sparked renewed interest in the histologic connection of these cells with the neurones of the retina. Present evidence suggests that these Müller cells serve for the efficient funnelling of substrates to the nerve cells and may take the place of extravascular spaces in the retina.

Heading the new studies in electron microscopy at the Laboratory has been Dr. Kuwabara. In addition we have been most fortunate in obtaining for our staff Dr. Oikawa who has had extensive experience in Japan both in the biologic and engineering

aspects of electron microscopy. Also Dr. Kroll is spending a Fellowship year with us assigned to electron microscopy. To date we feel most satisfied with our venture into this field.

*Neuro Ophthalmology.* Over the years the Howe Laboratory has operated an informal but real neuro-ophthalmic service at the Infirmary and Massachusetts General Hospital. The fortunate position of the Laboratory in the midst of these two hospitals has provided a favorable environment for contact between ophthalmology and neurology and for the development of a vigorous training and research program in neuro-ophthalmology.

Neuro-ophthalmic studies completed this past year were an analysis of skew deviation in brain stem disease, an analysis of monocular blackouts, and a report of a unique case of ganglioneuroma of the chiasm. We also participated in several symposia concerning problems of ocular motility. Presently two Fellows, Drs. Fred Dushay and David Knox, are attached to the Laboratory as trainees in neuro-ophthalmology. Were space available several more could be profitably attached to the Laboratory.

*Miscellaneous.* The osmotic pressure of the corneal stroma has profound significance from a practical and theoretical point of view. There can be little doubt that the relation between it and that of the fluid in the tears and aqueous humor determines the swelling, clarity, and fluid exchange of the cornea. This past summer it has been possible to obtain direct measurements of this osmotic tension using a microcryoscopic technique with samples as small as one ten millionth of a cubic centimeter. Richard Brubaker and Brent Lambert, medical students assigned to the Laboratory on summer Fellowships, were able to measure the osmotic pressure of the stroma with a standard deviation of only 5 *milliosmoles*. Results showed that when the effect of evaporation has been eliminated, stromal interstitial fluid is isotonic with anterior aqueous humor. The results also suggested that there exists an osmotic gradient from limbus to center, but the difference measured was so small that it was not statistically significant.

The congenital abnormality known as sclerocornea was studied in a series of eight patients by Drs. Goldstein and Cogan leading them to conclude that the anomaly is a severe form of what occurs

in a mild and asymptomatic variety known as embryotoxon where the iris is adherent to the periphery of the cornea.

The possibility of turning up information bearing on retinitis pigmentosa is being pursued in dogs that have a blinding disease analogous to retinitis pigmentosa of human beings. Breeding experiments are underway which, if successful in bringing out the trait regularly, may be a means of providing valuable subjects for a fundamental study of this disease. A biochemical and histochemical study would seem to be at present the most logical approach to this tragic affliction of man (and animals).

A continuing interest in histopathology and a close collaboration with the Pathology Laboratory has resulted in several specific projects. Dr. Kuwabara and Dr. Jay Richlin have studied amyloid deposits in the lid. Dr. Richard Simmons and Dr. Cogan are studying a series of patients with what they call occult temporal arteritis; these patients develop retinal arterial occlusion but manifest no signs at the onset referable to the temporal arteries although later biopsy reveals a typical giant cell arteritis. Dr. Kuwabara collaborated with Dr. Harisijades, visiting scientist at the Harvard School of Public Health, in demonstrating abundant inclusion bodies in the eyes of chicken embryos after inoculation of the yolk sac with trachoma virus. Dr. Cogan and Dr. Kuwabara have made the first histologic examination of cataracts in a patient with mongolism. The observations on this cataract and on the cataract of another mental defective have suggested a dystrophy whereby islands of lens capsule are segregated and dropped off into the cortex. This may underlie the origin of the discrete opacities of the cerulean-coronary type of cataract.

The December meeting of the Harvard Medical Society was devoted to reports from the Howe Laboratory. The four topics selected for discussion were: Reactions initiating Glucose Metabolism in the Lens (Dr. Kinoshita), Enzymatic Oxidation of Vitamin A Aldehyde (Dr. Futterman), Hydrodynamic Problems in the Eye (Dr. Grant), and Retinal Vascular Patterns (Dr. Kuwabara).

#### SERVICE ACTIVITIES

Training is an integral part of the Howe Laboratory's functions. It is our aim to provide facilities so far as space and resources per-

mit for those who have the inquisitiveness and perseverance to study problems referable to the eye. Some trainees are motivated by a specific problem in which they need help. Some wish laboratory experience in ophthalmic research during their pre-residency or post-residency period. Some aim for a feel of research by spending a few months during their undergraduate years. Whatever the motives and regardless of whether a person is to be a clinician or laboratory investigator, the time in a Laboratory is thought to be well spent. It is also a profitable investment from the Laboratory's point of view for the fresh approach of these trainees often leads to significant researches. It is, therefore, with enthusiasm that we have decided to set aside a portion of the newly acquired penthouse facilities for prospective residents who aim for a career in academic ophthalmology and wish to spend a year in the Laboratory prior to the clinical portion of their residencies. This program will be under the direction of Dr. Kupfer and will encourage independent laboratory investigation.

Photography in the Howe Laboratory serves both a research and service function. Elsewhere we have described the new techniques and cameras developed by Dr. Donaldson. These have produced an unparalleled wealth of teaching material. The photographic illustrations of clinical conditions are in daily use by medical students, residents, and visitors. Three dimensional fundus photography with a camera designed by Dr. Donaldson and built by Mr. Werner Mueller in our machine shop has given a new impetus to expansion of the collection. Dr. Stewart Bruch joined the Laboratory for a few months to document the photographs with clinical data and similarly Dr. Edward Goodman joined the Laboratory for a few months to document the pathologic specimens which have been photographed over the past few years. All photographs that are put in the teaching collection thus have a record sheet for ready review.

In an attempt to forestall the service functions from throttling the research activities, some of the routine photography has been transferred to a small room apart from the Laboratory. This will provide service photography on a cost basis and be supervised by the Laboratory.

The Laboratory has furnished the Museum of Science with a large mural photograph of the retinal vessels. This will serve,

we understand, as a backdrop for the new exhibit on Circulation. The Museum of Science also has on permanent display several stereoscopic photographs of the eyes from Dr. Donaldson's collection.

The Howe Library is administratively distinct from the Laboratory but there is much overlap of functions and responsibilities; approximately one quarter of the Library's expenses come from restricted Howe funds. We have heard it said that the Library, under the efficient and pleasant stewardship of Charles Snyder, is a model of service to the local scientific community.

The Eye Pathology Laboratory, under the direction of Dr. Taylor Smith, is also administratively distinct from the Laboratory but the two operate in close and mutually profitable collaboration.

#### ORGANIZATION AND PERSONNEL

The Laboratory suffered a severe tragedy in the loss, by death, of Dr. Edward Sweebe. With full knowledge of the eventually lethal nature of Hodgkins disease which had plagued him for years, Dr. Sweebe pursued his corneal studies with admirable cheerfulness and fortitude. As a Fellow in the Howe Laboratory he had been a key figure in setting up a Corneal Transplant Service and was vigorously pursuing a research program with Dr. Kuwabara at the time of his death. This research, aimed at determining the survival period of transplanted corneal cells, will be continued as Dr. Sweebe would have wished.

During the past year Dr. Cogan served as President of the New England Ophthalmological Society; Dr. Grant continued as member of the Sensory Disease Study Section of the National Institute of Neurologic Diseases and Blindness; Dr. Kinoshita continued as the perennial Chairman of the Annual Conference on Ophthalmic Biochemistry; and Dr. Cogan continued as Editor-in-Chief of the Archives of Ophthalmology.

As noted sporadically throughout this Report, Fellows in training at the Howe Laboratory have been: Dr. Ephraim Friedman in experimental pathology, Drs. Dushay and Knox in neuro-ophthalmology, Dr. Thomas Hutchinson in ocular histochemistry, Dr. Arnold Kroll in electron microscopy and Dr. Christman in

neurophysiology. Medical students attached to the Laboratory for several months' experience in research methods have been Richard Brubaker and Brent Lambert working on corneal physiology.

The Laboratory has expanded several fold in the past several years. We have been most fortunate in having the moral and financial backing of a number of agencies and persons who understand what we are doing and support us generously. Without their help our efforts would amount to little. It is therefore a great pleasure to express appreciation to the following who, together with the industry of my colleagues, have made this a most satisfactory year.

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National Council to Combat Blindness, Inc.  
Studies of retinitis pigmentosa in dogs

National Science Foundation  
Development of equipment for producing stereograms

Alfred P. Sloan Foundation  
Sixth Conference on Biochemistry  
Studies on intraocular fluids and glaucoma

## U.S. Air Force

Studies on metabolism of the ocular lens

## U.S. Atomic Energy Commission

Studies on metabolism of the ocular lens

## U.S. Public Health Service

Training purposes

Studies on tonography of the eye

Studies on toxicology of the eye

Studies on metabolism of the ocular lens and retina

Studies on fat metabolism

Electron microscopy

Metabolic histochemistry of the retina

Studies on corneal grafts

Instrumentation in ophthalmology

Studies on subjective color phenomena

Photographic recording of ophthalmic diseases

Studies on the development of the anterior chamber angle

Studies on experimental toxoplasmosis

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DAVID G. COGAN, M.D.

*Director*

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Through a rope — around a corner. 65:162, February 1961.  
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HERMAN JACOB KNAPP, *Arch. Ophthal.* 66:596-598, October 1961.  
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ALVIN ALLACE HUBBELL, M.D. *Arch. Ophthal.* 66:906, December 1961.
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## LECTURES

ANDREWS, J. S.

Net triglyceride synthesis by rabbit cornea, *in vitro*. Sixth Conference on Ophthalmic Biochemistry, in Dedham, Massachusetts, February 25–26, 1961.

Lipides of the eye. Series of lectures to the Postgraduate Course in Ophthalmology, Harvard Medical School, in Boston, Massachusetts, September 27–October 20, 1961.

COGAN, D. G.

Retinal vessels. Postgraduate Course in Cardiology, Massachusetts General Hospital, in Boston, Massachusetts, February 9, 1961.

Nystagmus. Symposium on Extraocular Muscles. New Orleans Academy of Ophthalmology, in New Orleans, Louisiana, February 20–23, 1961.

Radiation hazards to the eye. Postgraduate Course in Harvard School of Public Health, in Boston, Massachusetts, April 13 and 20, 1961.

Brain lesions and eye movements in man. Symposium on the Oculomotor System. Mt. Sinai Hospital, in New York, New York, April 14–15, 1961.

More about retinal vessels. Alumni Association Meeting of the Massachusetts Eye and Ear Infirmary, in Boston, Massachusetts. April 25, 1961.

Vascularization of the cornea. Symposium on the Cornea. Association for Research in Ophthalmology, in New York, New York, June 26–28, 1961.

Blackouts not obviously due to carotid occlusion. American Medical Association Scientific Assembly, Section on Ophthalmology, in New York, New York, June 28, 1961.

Discussion: The physiological significance of gerontoxon, especially in younger individuals. Finley, J. and Berkowitz, D. American Medical Association Scientific Assembly, Section on Ophthalmology, in New York, New York, June 28, 1961.

Histochemistry. Series of lectures to the Postgraduate Course in Ophthalmology, Harvard Medical School, in Boston, Massachusetts, September 27–October 20, 1961.

Investigators and investors. The case for the support of ophthalmic research. Massachusetts State Federation of Women's Clubs, in Boston, Massachusetts, October 5, 1961.

Neuro-ophthalmology. Series of lectures to the Postgraduate Course in Ophthalmology, Harvard Medical School, in Boston, Massachusetts, October 27–November 10, 1961.

Moderator. Studies on the eye. Harvard Medical Society, in Boston, Massachusetts, December 12, 1961.

Ophthalmic pathology. Department of Pathology, Harvard Medical School, in Boston, Massachusetts, December 16, 1961.

House Officer Lectures:

Nystagmus. Massachusetts Eye and Ear Infirmary, January 12, 1961.

Nystagmus. Veterans Administration Hospital, February 14, 1961.

Group diseases. Arthritis Unit, Massachusetts General Hospital, April 3, 1961.

Neuro-ophthalmology. Children's Hospital, April 22, 1961

Retinal blood vessels. Massachusetts General Hospital, April 28, 1961.

Blackouts. Massachusetts Eye and Ear Infirmary, June 22, 1961.

Pathology. Massachusetts Eye and Ear Infirmary, November 16 and 21, 1961.

DONALDSON, D. D.

House Officer Lectures, Massachusetts Eye and Ear Infirmary:

Iris lesions. January 31, 1961.

Techniques in cataract surgery. March 21, 1961.

Report on the Third International Barraquer Course. May 18, 1961.

Systemic disease. May 25, 1961.

Gonioscopy. August 15, 1961.

Post graduate Course in Ophthalmology, Harvard Medical School:

Gonioscopy. January 16 and 17, 1961.

Corneal dystrophy. January 20, 1961.

The anterior segment and systemic disease. February 17, 1961.

Neuro-ophthalmic anatomy. September 26–October 20, 1961.

Louisiana State University Medical School and Tulane Medical School, in New Orleans, Louisiana, March 2–4, 1961:

Pathognomonic signs of systemic disease in the eye.

Pathology in the anterior chamber.

Corneal dystrophies, degenerations and keratopathies.

Eye manifestations of systemic disease.

Tumors and cysts of the iris and ciliary body.

Anatomical correlation with neuro-ophthalmic disorders.

Third Year Medical Students, Harvard Medical School:

Motor neuro-ophthalmology. March 9, 1961.

Visual neuro-ophthalmology. March 14, 1961.

Systemic disease, metabolic and hereditary. March 16, 1961.

A new fundus camera for taking simultaneous stereoscopic photographs. Alumni Association Meeting of the Massachusetts Eye and Ear Infirmary, in Boston, Massachusetts, April 25, 1961.

The eye as a window to disordered metabolism. Postgraduate Course in Pediatrics, Harvard Medical School, in Boston, Massachusetts, June 9, 1961.

External diseases of the eye. Series of lectures to the Lancaster Courses in Ophthalmology, in Waterville, Maine, July 21, 1961.

State University of Iowa, Iowa City, Iowa, August 1-2, 1961:

Diseases in the eye associated with metabolic and endocrine disorders.

Systemic syndromes involving the eye.

Various types of eye diseases which can be recorded. School of Aerospace Medicine, in San Antonio, Texas, September 7, 1961.

Eye conditions related to systemic diseases. The American Academy of General Practice, in Portland, Maine, October 7, 1961.

Clinical ocular findings in Wilson's disease and gargoylism. New England Ophthalmological Society, in Boston, Massachusetts, November 15, 1961.

Kansas City Society of Ophthalmology and Otolaryngology, in Kansas City, Kansas, December 6, 1961:

Some fundus lesions.

Inflammatory conditions of the cornea.

Iris tumors: Their diagnosis and treatment.

Clinical Conferences: Medico-neuro-ophthalmology. New England Ophthalmological Society, in Boston, Massachusetts, January 18, February 15, March 15, April 26, November 15, December 20, 1961.

DUSHAY, F.

Neuro-ophthalmology. Series of lectures to the Postgraduate Course in Ophthalmology, Harvard Medical School, in Boston, Massachusetts, October 27-November 10, 1961.

FUTTERMAN, S.

with SASLAW, L. D.: Determination of vitamin A aldehyde. Sixth Conference on Ophthalmic Biochemistry, in Dedham, Massachusetts, February 25-26, 1961.

Biochemistry of the retina. Postgraduate Course in Ophthalmology, Harvard Medical School, in Boston, Massachusetts, October 6, 1961.

Enzymatic oxidation of vitamin A aldehyde. Harvard Medical Society, in Boston, Massachusetts, December 13, 1961.

GRANT, W. M.

Discussion: Ocular zinc concentrations. Galvin, M. A., Nano, H. and Hall, T. Association for Research in Ophthalmology. June 26, 1961.

House Officer Lectures, Massachusetts Eye and Ear Infirmary:

Filtering procedures in glaucoma. March 23, 1961.

Glaucoma of infants and children. July 18, 1961.

Toxicology, tonometry and tonography. Series of lectures to the Lancaster Courses in Ophthalmology, in Waterville, Maine, August 24 and 25, 1961.

Postgraduate Course in Ophthalmology, Harvard Medical School, in Boston, Massachusetts:

Toxicology. October 10 and 11, 1961.

Pathology of glaucoma. December 4, 1961.

Problems of ocular hydrodynamics. Harvard Medical Society, in Boston, Massachusetts, December 12, 1961.

Ophthalmic pharmacology. Department of Pharmacology, Harvard Medical School, in Boston, Massachusetts, December 16, 1961.

KAUFMAN, H. E.

Herpes simplex keratitis. Alumni Association Meeting of the Massachusetts Eye and Ear Infirmary, in Boston, Massachusetts, April 25, 1961.

Association for Research in Ophthalmology, in Detroit, Michigan, December 6, 1961:

Review of herpes simplex keratitis.

Antibody tests for ocular toxoplasmosis.

Uveitis. New England Ophthalmological Society, in Boston, Massachusetts, December 20, 1961.

KINOSHITA, J. H.

Chairman. Sixth Conference on Ophthalmic Biochemistry, in Dedham, Massachusetts, February 25-26, 1961.

Discussion: Ribonucleic acid in rabbit lenses. Dische, Z. Association for Research in Ophthalmology, in New York, New York, June 26, 1961.

Biochemistry of cornea and lens. Series of lectures to the Postgraduate Course in Ophthalmology, Harvard Medical School, in Boston, Massachusetts. September 27-October 20, 1961.

Discussion: Respiratory activity of the rat lens. Sippel, T. O. Association for Research in Ophthalmology, in Detroit, Michigan, December 5, 1961.

Reactions initiating the glucose metabolism in the lens. Harvard Medical Society, in Boston, Massachusetts. December 12, 1961.

KNOX, D. L.

Neuro-ophthalmology. Series of lectures to the Postgraduate Course in Ophthalmology, Harvard Medical School, in Boston, Massachusetts, October 27-November 10, 1961.

Ocular signs of trauma to the cerebral vessels. House Officer Lecture, Massachusetts Eye and Ear Infirmary, in Boston, Massachusetts, December 19, 1961.

KUPFER, C.

House Officer Lectures, Massachusetts Eye and Ear Infirmary:

Anatomical basis of field defects. February 23, 1961.

Foveal vision testing. May 2, 1961.

Amblyopia. July 13, 1961.

Recent advances in aqueous humor dynamics. October 5, 1961.

Third Year Medical Students, Harvard Medical School:

Eye signs in diabetes. March 2, 1961.

Eye signs of atherosclerosis and hypertension. March 16, 1961.

The effect of aqueous humor drainage on intraocular pressure. Wilmer Meeting, Johns Hopkins Hospital, in Baltimore, Maryland. March 24, 1961.

Aqueous humor dynamics. Series of lectures to the Postgraduate Course in Ophthalmology, Harvard Medical School in Boston, Massachusetts. October 3-11, 1961.

Visual centers without end organ stimulation. Mobility Research Conference, Massachusetts Institute of Technology, in Cambridge, Massachusetts. October 12, 1961.

Electrophysiology. Postgraduate Course in Ophthalmology, Harvard Medical School, in Boston, Massachusetts. December 7, 1961.

KUWABARA, T.

Histochemical demonstration of oxidative enzymes by whole tissue incubation. Sinai Hospital, in Baltimore, Maryland. March 21, 1961.

Vascular pattern of the retina. Washington Pathology Club, in Washington, D. C. March 22, 1961.

Anatomy and pathology of retinal vasculature. House Officer Lecture, Massachusetts Eye and Ear Infirmary, in Boston, Massachusetts, April 13, 1961.

Discussion: The application of nitro-blue tetrazolium to ocular histochemistry. Patz, A. and Berkow, J. W. Association for Research in Ophthalmology. June 26, 1961. In New York, New York.

Histochemistry of the retina and the optic nerve. Postgraduate Course in Ophthalmology, Harvard Medical School, in Boston, Massachusetts. September 27-October 20, 1961.

Vascular changes in diabetic retinopathy. Endocrinology Department, Massachusetts General Hospital, in Boston, Massachusetts. October 10, 1961.

Retinal vessels. Pathology Department, Massachusetts General Hospital, in Boston, Massachusetts. November 3, 1961.

Retinal vessels. Harvard Medical Society, in Boston, Massachusetts, December 12, 1961.

Pathology of vascular system of the eye. Postgraduate Course in Ophthalmology, Harvard Medical School, in Boston, Massachusetts. December 13, 1961.

REINECKE, R. D.

Postgraduate Course in Ophthalmology, Harvard Medical School:

Visual acuity measurements. February 7, 1961.

Opticokinetic nystagmus. February 9, 1961.

Retinal ischemia in cats. Alumni Association Meeting of the Massachusetts Eye and Ear Infirmary, in Boston, Massachusetts. April 25, 1961.

SNYDER, C.

House Officer Lectures, Massachusetts Eye and Ear Infirmary:

The first forty years of the Massachusetts Eye and Ear Infirmary.

March 23, 1961.

The effective use of ear, nose and throat literature. April 18, 1961.

Three young men from Vienna, or "Fustest with the Mostest". New England Ophthalmological Society, in Boston, Massachusetts, December 20, 1961.

SPECTOR, A.

Lens amino acid esterase activity. Sixth Conference on Ophthalmic Biochemistry, in Dedham, Massachusetts. February 25-26, 1961.

Ophthalmic biochemistry. Postgraduate Course in Ophthalmology, Harvard Medical School, in Boston, Massachusetts. October 16, 1961.

TOUSSAINT, D.

with Kuwabara, T. and Cogan, D. G.: Histologic changes in retinal vessels with diabetes. New England Ophthalmological Society, in Boston, Massachusetts. March 15, 1961.

#### EXHIBIT

Toussaint, D., Kuwabara, T. and Cogan, D. G.: Retinal Vascular Patterns. American Medical Association, in New York, New York, June 26-30, 1961.



## FORM OF BEQUEST

The Howe Laboratory of Ophthalmology is an independent department of the Harvard Medical School and is jointly supported by a restricted endowment of Harvard University and by the Massachusetts Eye and Ear Infirmary.

For the information of those who may wish to contribute to this Laboratory, a form of bequest is here set forth:

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